Ishibashi and Shigematsu Laboratories (Special Issue on the Commemoration of the Fortieth Anniversary)

ISHIBASHI LABORATORY (July 1942～December 1959)

Head: Dr. Masayoshi Ishibashi

and

SHIGEMATSU LABORATORY (June 1957～)

Head: Dr. Tsunenobu Shigematsu

In the Ishibashi laboratory, the chemistry of sea water, sea lives and sea muds was extensively studied under the direction of Professor M. Ishibashi. While many papers had been published in the Journal of Chemical Society of Japan and the Journal of Oceanographic Society of Japan, the articles published in the Bulletin of the Institute for Chemical Research, Kyoto University and related mainly to the chemistry of sea muds were listed as follows. Some of the other articles dealing with the chemistry of ocean would be found in the list of publications of Shigematsu laboratory.

Publications

1. M. Ishibashi and T. Hara: Chemical Studies on the Ocean. On the Amount of Cesium Dissolved in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.*, **32,** 248 (1954).
2. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. Chemical Studies of the Shallow Water Deposits (3). On the Chemical Constituents of the Shallow Water Deposits along the Sea Coasts of Korea, *Bull. Inst. Chem. Res., Kyoto Univ.*, **33,** 165 (1955).
3. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. XLVIII. Chemical Studies of the Shallow Water Deposits along the Sea Coasts of Korea, *Bull. Inst. Chem. Res., Kyoto Univ.*, **33,** 170 (1955).
4. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LI. Chemical Studies of the Shallow Water Deposits (7). On the Chemical Constituents of the Shallow Water Deposits along the Sea Coasts of Ishikawa and Toyama Prefectures, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 117 (1956).
5. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LII. Chemical Studies of the Shallow Water Deposits. On the Chemical Constituents of the Sea Coast of Aichi Prefecture, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 122 (1956).
6. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LIII. Chemical Studies of the Shallow Water Deposits along the Sea Coasts of Niigata, Yamagata and Akita Prefectures, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 127 (1956)
7. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LIV. Chemical Studies of the Shallow Water Deposits (10). On the Chemical Constituents of the Sea Coast of Hiroshima Prefecture, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 132 (1956).
8. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LV. Chemical Studies of the Shallow Water Deposits (11). On the Chemical Constituents of the Shallow Water Deposits along the Sea Coasts of Aomori and Iwate Prefectures, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 137 (1956).
9. M. Ishibashi and S. Ueda: Chemical Studies on the Ocean. LIX. Chemical Studies of the Shallow Water Depiosits (12). On the Chemical Constituents of the Shallow Water Deposits along the Sea Coast of Okayama Prefecture, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34,** 235 (1956).

10. M. Ishibashi and S. Ueda: Chemical Studies of the Ocean. LX. Chemical Studies of the Shallow Water Deposits along the Sea Coasts of Yamaguchi and Shimane Prefectures, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34**, 240 (1956).
11. M. Ishibashi, S. Ueda and Y. Yamamoto: Chemical Studies on the Ocean. LXI. Chemical Studies of the Shallow Water Deposits (14). On the Chemical Constituents of the Shallow Water Deposits along the Sea Coasts to Tottori and Hyogo Prefectures, *Bull. Inst. Chem. Res., Kyoto Univ.*, **34**, 245 (1956).
12. M. Ishibashi and S. Higashi: Estimation of the Microgram Amount of Thorium in the Lake Biwa Water, *Bull. Inst. Chem. Res., Kyoto Univ.*, **35**, 1 (1957).
13. M. Ishibashi, S. Ueda and Y. Yamamoto: Chemical Studies on the Ocean. LXX. Cobalt Content of Shallow Water Deposits (1), *Bull. Inst. Chem. Res., Kyoto Univ.*, **37**, 26 (1959).
14. M. Ishibashi, S. Ueda and Y. Yamamoto: Chemical Studies on the Ocean. LXXI. Cobalt Content of Shallow Water Deposits (2), *Bull. Inst. Chem. Res., Kyoto Univ.*, **37**, 31 (1959).
15. M. Ishibashi and T. Hara: On the Determination of Potassium in Dilute Solution and its Application to the Analysis of Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.*, **37**, 167 (1959).
16. M. Ishibashi and T. Hara: On the Amount of Cesium Dissolved in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.*, **37**, 179 (1959).
17. M. Ishibashi and T. Hara: A Systematic Analysis of Potassium, Rubidium and Cesium and its Application to Sea Muds, *Bull. Inst. Chem. Res., Kyoto Univ.*, **37**, 185 (1959).

The Shigematsu laboratory established in June 1957, is in the building of the Radioisotope Research Laboratory and under the direction of Professor T. Shigematsu.

In this laboratory, some basic researches in the field of radiochemistry, geochemistry and analytical chemistry have been performed. The subjects have so far been investigated are follows.

I. Solvent Extraction

The solvent extraction of metal chelates plays an important role in the separation and purification of trace metals. The problems deal mainly with the solvent extraction of metal β-diketonates. The extraction behavior of metal chelates with β-diketones, such as acetylacetone, benzoyltrifluoroacetone, dibenzoylmethane, were studied, and the methods for the separation and the spectrophotometric determination of some metals were proposed. Some conciderations were made on the relationships between the ionic potentials of central metal ions and the extractability of the acetylacetonates.

The synergistic effect of oxygen- and nitrogen-containing solvents on the extraction of europium ion with a fluorinated β-diketone, benzoyltrifluoroacetone were also studied, and the usefulness of the synergistic effect in the extraction of rare earth ions with β-diketones were concidered.

II. Nuclear Chemistry

The decay scheme of ^{150}Eu and ^{157}Tb were studied.

III. Treatment of Radioactive Wastes

Chemical precipitation methods and ion-exchange methods for liquid waste disposal were studied.

IV. Coprecipitation

Coprecipitation has been used for the chemical concentration of trace elements from dilute solutions and for the separation of radioisotopes. The coprecipitation behavior of storontium, scandium, yttrium and lanthanides with calcium oxalate from a homogeneous system was studied. The results showed that the most predominant factors affecting the distribution coefficient are the pH value of the solution and the concentration of the organic acid, and the ionic radius also plays an important role in the coprecipitation process.

V. Geochemistry

As Professor T. Shigematsu studied on the problems of analytical and oceanochemistry, before he joined the Institute in April 1957, under direction of Professor M. Ishibashi, he worked on the subjects of marine chemistry.

VI. Analytical Chemistry

The problems deal principally with the spectrophotometric and fluorometric methods.

Publications

(* indicates an article published in Japanese)

I. Solvent Extraction

1. T. Shigematsu and M. Tabushi: Solvent Extraction of Beryllium as Acetylacetonate, *Nippon Kagaku Zasshi,* **80,** 159 (1959).*
2. T. Shigematsu and M. Tabushi: Spectrophotometric Determination of Beryllium with Acetylacetone, Application to the Analysis of Aluminum Alloy, *Nippon Kagaku Zasshi,* **80,** 162 (1959).*
3. M. Ishibashi, T. Shigematsu and M. Tabushi: Simultaneous Determination of Uranium and Iron by the Solvent Extraction as Acetylacetonates, *Nippon Kagaku Zasshi,* **80,** 1018 (1959).*
4. T. Shigematsu and M. Tabushi: Spectrophotometric Determination of Uranium using Acetylacetone as a Reagent, *Japan Analyst,* **8,** 253 (1959).*

T. T. Shigematsu and M. Tabushi: Carrier-free Separation of Phosphorus-32 by Solvent Extraction Method, *Japan Analyst,* **8,** 261 (1959).*

6. T. Shigematsu and M. Tabushi: Spectrophotometric Method for the Determination of Ferric Iron with Acetylacetone, *Japan Analyst,* **8,** 711 (1959).*
7. M. Tabushi: Solvent Extraction of Uranium with Chloroform as Acetylacetonate, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 226 (1959).
8. M. Tabushi: Solvent Extraction of Iron with Chloroform as Acetylacetonate, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 232 (1959).
9. M. Tabushi: Spectrophotometric Determination of Uranium by Solvent Extraction as Acetylacetonate, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 237 (1959).
10. M. Tabushi: Spectrophotometric Determination of Iron by Solvent Extraction as Acetylacetonate, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 245 (1959).
11. M. Tabushi: Solvent Extraction of Metal Acetylacetonates, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 252 (1959).
12. T. Shigematsu and M. Tabushi: Spectrophotometric Method for the Determination of Iron with Dibenzoylmethane, *Nippon Kagaku Zasshi,* **81,** 262 (1960).*

13. T. Shigematsu and M. Tabushi: Separation and Spectrophotometric Determination of Uranium by the Extraction of Dibenzoylmethane Chelate with Butylacetate, *Nippon Kagaku Zasshi,* **81,** 265 (1960).*
14. T. Shigematsu and M. Tabushi: Extraction Behavior of Metal Acetylacetonates, *Bull. Inst. Chem. Res., Kyoto Univ.,* **39,** 35 (1961).
15. T. Shigematsu and M. Tabushi: Countercurrent Distribution of Iron and Copper in Acetylacetone Butyl Acetate System, *Bull. Inst. Chem. Res., Kyoto Univ.,* **40,** 374 (1962).
16. T. Shigematsu, M. Tabushi and T. Tarumoto: Dibenzoylmethane as Chelating Reagent in Solvent Extraction and Spectrophotometric Determination, *Bull. Inst. Chem. Res., Kyoto Univ.,* **40,** 388 (1962).
17. T. Shigematsu and M. Tabushi: Solvent Extraction of Manganese as Acetylacetonates, *Nippon Kagaku Zasshi,* **83,** 814 (1962).*
18. T. Shigematsu, M. Tabushi and T. Tarumoto: Solvent Extraction of Dibenzoylmethane Complexes, *Nippon Kagaku Zasshi,* **84,** 131 (1963).*
19. T. Shigematsu, M. Tabushi, M. Matsui, Y. Nishikawa and S. Goda: Solvent Extraction Separation of Scandium from Yttrium and Rare Earth Elements, *Nippon Kagaku Zasshi,* **84,** 263 (1963).*
20. T. Shigematsu, M. Tabushi and M. Matsui: Solvent Extraction and Spectrophotometric Determination of Uranium using Benzoyltrifluoroacetone as the Chelating Reagent, *Bull. Chem. Soc. Japan,* **37,** 1333 (1964).
21. T. Shigematsu, M. Tabushi and M. Matsui: Separation of Zirconium-95 by Solvent Extraction using Acetylacetone, *Bull. Inst. Chem. Res., Kyoto Univ.,* **41,** 212 (1963).
22. T. Shigematsu, M. Matsui and M. Tabushi: Separation of Zirconium-95 and Niobium-95 by Solvent Extraction using Trifluoroacetylacetone and Benzoyltrifluoroacetone, *Bull. Inst. Chem. Res., Kyoto Univ.,* **43,** 339 (1965).
23. T. Shigematsu, Y. Nishikawa, S. Goda and H. Hirayama: N-Benzoyl-N-phyenylhydroxylamine as a Reagent for the Separation of Niobium-95 from Zirconium-95 and for the Spectrophotometric Determination of Zirconium and Niobium, *Bull. Inst. Chem. Res., Kyoto Univ.,* **43,** 347 (1965).
24. T. Shigematsu, M. Tabushi, M. Matsui and T. Honjyo: The Solvent Extraction of Europium Ions with Benzoyltrifluoroacetone. The Synergistic Effect of Oxygen- and Nitrogen-containing Solvent, *Bull. Chem. Soc. Japan,* **39,** 165 (1966).

II. Nuclear Chemistry

1. Y. Yoshizawa, H. Okamura, S. Iwata, I. Fujiwara, T. Shigematsu, M. Tabushi, T. Tarumoto and K. Sakamoto: Decay of ^{150}Eu, *Nuclear Phys.,* **46,** 78 (1963).
2. I. Fujiwara, S. Iwata, T. Nishi, S. Goda, M. Tabushi and T. Shigematsu: Decay of ^{157}Tb, *Nuclear Phys.,* **50,** 346 (1964).
3. T. Shigematsu, M. Tabushi, S. Goda, K. Tamaki and Y. Nishikawa: Activation Analysis of Manganese by Pu-Be Neutron Sourse, *Radioisotopes,* **13,** 13 (1964).*

III. Treatment of Radioactive Wastes

1. T. Shigematsu, T. Oshio and K. Murata: Studies on the Radioactive Disposal. Treatments of Fission Products by Cation Exchangers, *Proc. 3rd Symposium of Atomic Energy, Japan,* 59 (1959).*
2. T. Shigematsu and T. Oshio: Effect of Cobalt-60 Gamma Radiation on Ion Exchange Resin, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 349 (1959).
3. T. Shigematsu and T. Oshio: Absorption of Cseium on Greensand in Sea Water, *J. Japanese Salt Science,* **14,** 185 (1960).*
4. T. Shigematsu and T. Oshio: Decontamination of Radioactive Contaminants from Water with Vermiculite, *Isotopes and Radiation,* **3,** 170 (1960).*
5. T. Shigematsu and T. Oshio: Separation of Cesium and Strontium from Fission Products by Cationic Resens with Phosphoric Group, *Isotopes and Radiation,* **4,** 105 (1961).*

IV. Coprecipitation

1. M. Ishibashi, T. Shigematsu, T. Ishida and M. Koyama: Coprecipitation of Fission Products on Ferric Hydroxide, *Bull. Inst. Chem. Res., Kyoto Uniiv.,* **38,** 145 (1960).
2. T. Shigematsu, M. Tabushi and M. Matsui: Coprecipitation of Scandium with Calcium Oxalate, *Bull. Inst. Chem. Res., Kyoto Univ.,* **40,** 381 (1962).
3. T. Shigematsu, M. Tabushi and M. Matsui: The Coprecipitation of Yttrium with Calcium Oxalate, *Bull. Chem. Soc. Japan,* **37,** 11 (1964).
4. M. Matsui: The Coprecipitation Behavior of Strontium with Calcium Oxalate by Precipitation from a Homogeneous System, *Bull. Chem. Soc. Japan,* **39,** 581 (1966).
5. M. Matsui: The Coprecipitation Behavior of Rare Earth Elements with Calcium Oxalate upon Precipitation from a Homogeneous System, *Bull. Chem. Soc. Japan,* **39,** 1114 (1966).

V. Geochemistry

1. M. Ishibashi, T. Shigematsu and Y. Nakagawa: Quantitative Determination of Vanadium in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.,* **24,** 68 (1951).
2. M. Ishibashi, T. Shigematsu and Y. Nakagawa: Quantitative Determination of Nickel and Cobalt in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.,* **26,** 68 (1951).
3. M. Ishibashi and T. Shigematsu: Chemical Studies on the Ocean (XL). On the Regularities of the Amounts of Elements Dissolving is Sea Water (2), *Bull. Inst. Chem. Res., Kyoto Univ.,* **27,** 42 (1951).
4. M. Ishibashi, T. Shigematsu and Y. Nakagawa: Determination of Selenium in Sea Water, *Records Oceano. Works in Japan,* **1,** 44 (1954).
5. M. Ishibashi, T. Shigematsu and Y. Nakagawa: Quantitative Determination of Tungsten and Molybdenum in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.,* **39,** 199 (1954).
6. M. Ishibashi, T. Shigematsu and Y. Nishikawa: On the Amount of Berylium in Sea Water, *Bull. Inst. Chem. Res., Kyoto Univ.,* **34,** 210 (1956).
7. M. Ishibashi, T. Shigematsu and S. Shibata: A New Method for the Determination of Bromide in Sea Water, *J. Japanese Salt Science,* **11,** 275 (1957).*
8. S. Higashi: Estimation of the Microgram Amount of Thorium in the Arima Hot Spring Waters and Deposits, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 198 (1959).
9. S. Higashi: Determination of the Solubility of Thorium Hydroxide, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 200 (1959).
10. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Determination of Manganese in Sea Water, *Records Oceano. Works in Japan,* **5,** 63 (1960).
11. M. Ishibashi, T. Shigematsu, Y. Nishikawa and Y. Ishibashi: Determination of Arsenic in Sea Water, *Records Oceano. Works in Japan,* **5,** 66 (1960).
12. T. Shigematsu, M. Tabushi, Y. Nishikawa, T. Muroga and Y. Matsunaga: Geochemical Study on Lakes Mikata, *Bull. Inst. Chem. Res., Kyoto Univ.,* **39,** 43 (1961).
13. M. Ishibashi, T. Shigematsu, Y. Nishikawa and K. Hiraki: Gallium Content of Sea Water, Marine Organisms, Sediments, and other Materials Related to the Ocean, *Nippon Kagaku Zasshi,* **82,** 1141 (1961).*
14. T. Shigematsu, M. Tabushi and F. Isojima: Determination of Beryllium in Biomaterials and Natural Water, *Japan Analyst,* **11,** 752 (1962).*
15. M. Ishibashi, T. Shigematsu, M. Tabushi, Y. Nishikawa and S. Goda: Determination of Cadmium in Sea Water, *Nippon Kagaku Zasshi,* **83,** 295 (1962).*
16. T. Shigematsu, Y. Nishikawa and K. Hiraki: Gallium Content in Rocks and Minerals, *Nippon Kagaku Zasshi,* **83,** 444 (1962).*
17. T. Shigematsu, M. Tabushi, Y. Nishikawa, K. Hiraki, S. Goda and R. Inoue: Determination of Scandium in Minerals and Sea Water, *Nippon Kagaku Zasshi,* **84,** 336 (1963).*
18. T. Shigematsu, Y. Nishikawa and T. Kusakabe: The Determination of Titanium in Sea Water, Marine Organisms and Sediments, *J. Japanese Salt Science,* **17,** 232 (1964).*
19. K. Uesugi, M. Tabushi, T. Murakami and T. Shigematsu: Spectrophotometric Determination of Strontium in Sea Water using 0-Cresolphthalein Complexon, *Japan Analyst,* **13,** 440 (1964).*

20. T. Shigematsu, M. Tabushi, T. Murakami and K. Uesugi: Behavior of Strontium in Concentration of Sea Water, *J. Japanese Salt Science,* **17,** 1 (1964).*
21. T. Shigematsu, M. Tabushi, K. Uesugi and T. Murakami: On the Precipitation Behavior of Strontium in Brine, *J. Japanese Salt Science,* **18,** 272 (1964).*
22. T. Shigematsu, Y. Nishikawa, K. Hiraki and H. Nakagawa: Determination of Zirconium in Sea Water, *Nippon Kagaku Zasshi,* **85,** 490 (1964).*
23. T. Shigematsu, K. Uesugi, T. Murakami and M. Tabushi: Spectrophotometric Determination of Strontium in Sea Water using 0-Cresolphthalein Complexon, *Japan Analyst,* **13,** 1032 (1964).*
24. T. Shigematsu, K. Uesugi and M. Tabushi: Behaviors of Rare Earth Elements in Concentrating Process of Sea Water, *Bull. Soc. Sea Water Science, Japan,* **19,** 3 (1965).*

VI. Analytical Chemistry

1. M. Ishibashi, T. Shigematsu and T. Ishida: A Study on Analysis of Carrier free Radioisotopes by Paper Chromatography, *Bull. Inst. Chem. Res., Kyoto Univ., Suppl. Issue,* 660 (1954).
2. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Studies on the Fluorometric Analysis V. Determination of Gallium with 8-hydroxyquinaldine, *Nippon Kagaku Zasshi,* **78,** 1139 (1957).
3. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Studies on the Fluorometric Analysis VI. Successive Determination of Gallium, Indium and Beryllium with 8-hydroxyquinaldine, *Nippon Kagaku Zasshi,* **78,** 1143 (1957).*
4. M. Ishibashi, T. Shigematsu, Y. Yamamoto, M. Tabushi and M. Kitayama: Ultraviolet Spectrophotometric Determination of Iron (III) as Acetato-complex, *Bull. Inst. Chem. Res., Kyoto Univ.,* **35,** 6 (1957).
5. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Fluorometric Determination of Aluminum with Pontachrome Blue Black R, *Japan Analyst,* **6,** 568 (1957).*
6. M. Ishibashi, T. Shigematsu, Y. Yamamoto, M. Tabushi and T. Kitagawa: Ultraviolet Spectrophotometric Determination of Iron (III) as Chloro-complex, *Bull. Chem. Soc,. Japan,* **30,** 433 (1957).
7. T. Shigematsu and M. Tabushi: Some Experiments in Precision Colorimetry, *Bull. Inst. Chem. Res., Kyoto Univ.,* **36,** 127 (1958).
8. T. Shigematsu: Fluorometric Determination of Trace Amount of Gallium in Germanium, *Japan Analyst,* **7,** 787 (1958).*
9. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Studies on the Fluorometric Analysis (Part IV). Fluorometric Determination of Gallium with 8-hydroxyquinoline, *Bull. Inst. Chem. Res., Kyoto Univ.,* **37,** 191 (1959).
10. M. Ishibashi, T. Shigematsu and Y. Nishikawa: Studies on the Fluorometric Analysis XII. Fluorometric Determination of Aluminium by Extraction of its Pontachrome Blue Black R Complex with Amylalcohol. Application to the Analysis of Pure Magnesium, *Nippon Kagaku Zasshi,* **81,** 259 (1960).*
11. T. Shigematsu, Y. Yamamoto, M. Tabushi and T. Kitagawa: Spectrophotometric Determination of Nickel by Mineral Acid, *Bull. Inst. Chem. Res., Kyoto Univ.,* **38,** 307 (1960)...
12. Y. Yamamoto, M. Tabushi, T. Kitagawa and T. Shigematsu: Spectrophotometric Determination of Cobalt by Mineral Acid, *Bull. Inst. Chem. Res., Kyoto Univ.,* **38,** 313 (1960).
13. Y. Nishikawa, K. Hiraki, S. Goda and T. Shigematsu: Spectrophotometric Determination of Scandium with Oxine or its Dihalogeno-derivatives, *Nippon Kagaku Zasshi,* **83,** 1264 (1962).*
14. T. Shigematsu, K. Uesugi and M. Tabushi: Spectrophotometric Method for the Determination of Scandium with Pontachrome Azure Blue B, *Japan Analyst,* **12,** 267 (1963).*
15. T. Shigematsu: Spectrophotometric and Fluorometric Determination of Trace Metals, *Japan Analyst,* **14,** 1193 (1965).*
16. T. Shigematsu, Y. Nishikawa and K. Hiraki: Fluorometric Determination of Yttrium with 5,7-dichlorooxine; Determination of Yttrium in Xenotime Ore, *Japan Analyst,* **15,** 493 (1966).*

Reviews

1. T. Shigematsu: Radiochemical Analysis, *Japan Analyst,* **6,** 914 (1957).*

2. T. Shigematsu: Some Uses of Radio-Isotopes in Analytical Chemistry, *Saishinno Kagaku to sono Oyo,* **9,** 1 (1957).*
3. T. Shigematsu and Y. Kusaka: Radioactivation Analysis, *Saishinno Bunseki-Kagaku,* **9,** 24 (1957).*
4. T. Shigematsu and T. Oshio: Treatments of Radioactive Waste, *Isotopes and Radiation,* **1,** 1 (1958).*
5. Y. Murakami, T. Shigematsu and others: Radiochemistry, *Japan Analyst,* **8,** 897 (1959).*
6. T. Shigematsu: Colorimetric Analysis. (I-VI), *Mizushiori-Gijutsu,* **1,** (1) 66 (1960); **1,** (2) 75 (1960); **1,** (3) 61 (1960); **1,** (4) 82 (1960); **1,** (5) 63 (1960); **1,** (6) 72 (1960).*
7. T. Shigematsu: Fluorometric Methods of Inorganic Analysis. (I-III), *Mizushiori-Gijutsu,* **2,** (9) 29 (1961); **2,** (10) 21 (1961); **2,** (11) 7 (1961).*
8. T. Shigematsu: Applications of Activation Analysis, *Saishinno Bunseki-Kagaku,* **12,** 1 (1961).*
9. T. Shigematsu: Treatment of Radioactive Waste, *Kagaku to Kogyo* (*Tokyo*), **13,** 1015 (1960).*
10. T. Shigematsu: Fluorometric Methods for Inorganic Analysis, *Kagaku* (*Kyoto*), **17,** 448 (1962).*
11. T. Shigematsu: Neutron Activation Analysis, *Kagaku* (*Kyoto*), **17,** 796 (1962).*
12. T. Shigematsu: Uses of Americium-241 as Radiation Source, *Kagaku* (*Kyoto*), **18,** 263 (1963).*
13. T. Shigematsu: Protactinium-231, *Kagaku* (*Kyoto*) **18,** 373 (1963).*
14. T. Shigematsu: Carrier-free Separation of Francium, *Kagaku* (*Kyoto*), **18,** 858 (1963).*
15. T. Shigematsu: A New Chemical Separation Method for the Radioactivation Analysis, *Kagaku* (*Kyoto*), **19,** 388 (1964).*
16. T. Shigematsu: Activation Analysis of Oxygen, *Kagaku* (*Kyoto*), **19,** 919 (1964).*
17. T. Shigematsu: Solubilities of Radioactive Compounds, *Kagaku* (*Kyoto*), **19,** 1050 (1964).*
18. T. Shigematsu: Activation Analysis, Kagaku-Kojo, **8,** No. 65 (1964).*
19. T. Shigematsu: Radiocolloid, *Kagaku* (*Kyoto*), **20,** 302 (1965).*
20. T. Shigematsu: Preparation of Radio-Isotopes with High Specific Activity, *Kagaku* (*Kyoto*), **20,** 724 (1965).*
21. T. Shigematsu: Trends of Radioactivation Analysis, *Kagaku* (*Kyoto*), **20,** 1149 (1965).*
22. T. Shigematsu: Synthetic Inorganic Ion Exchangers, (I), *Kagaku* (*Kyoto*), **21,** 111 (1966).*
23. T. Shigematsu: Syntehtic Inorganic Ion Exchangers (II). *Kagaku* (*Kyoto*), **21,** 215 (1966).*